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ENERGY
DESIGN**

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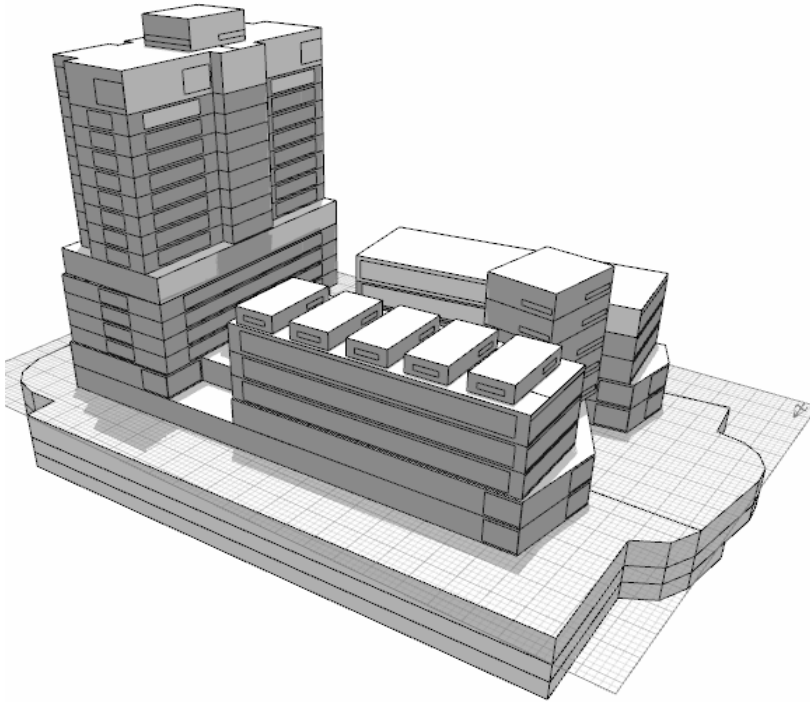
Shading Analysis Report for Prakriti Rose Project (UKN Properties, Bangluru)

Objective

The objective of this Energy efficiency measure exercise is to help Architects and the Developer assess the cost of realtime operation of the building Cooling system in three specific cases. The description of those cases is following

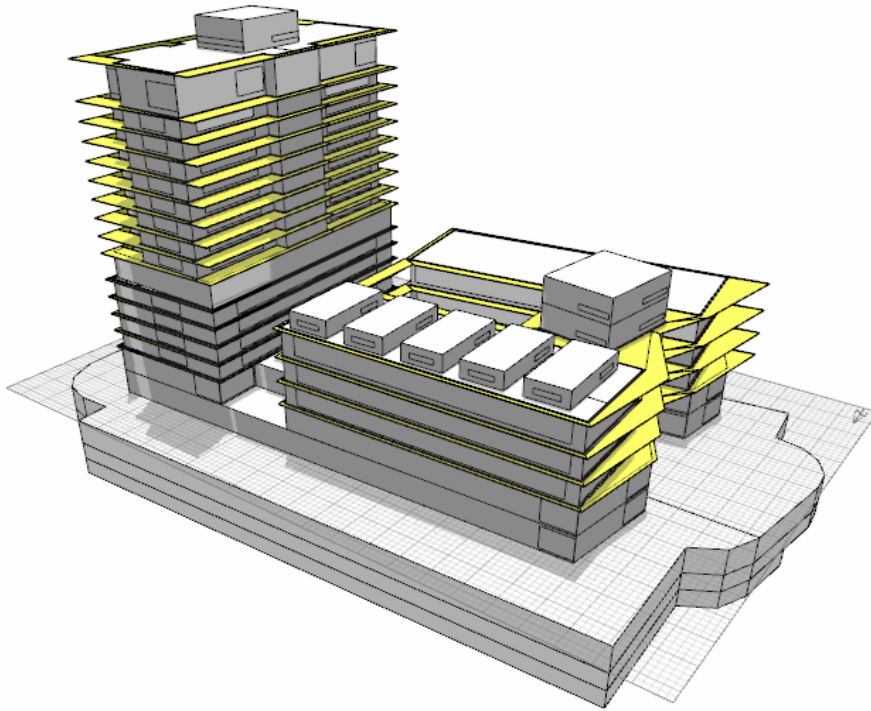
Case Description for Individual Cases

The case represent a Baseline building without having any sort of passive shading
Case 0 mechanism
Case Description Model for Base Case- Thermal Model



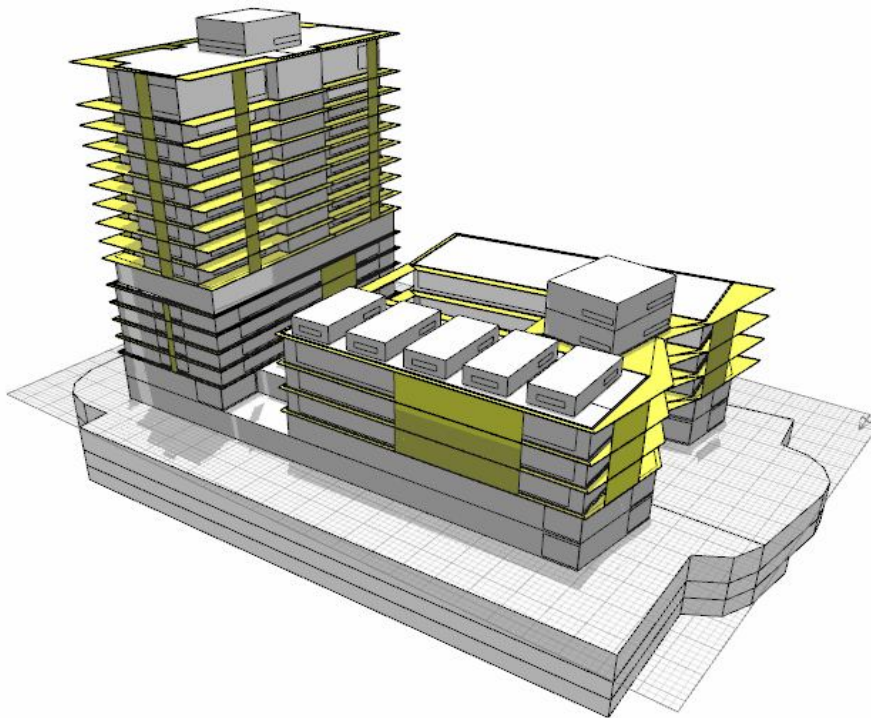
Case 1 This case represents passive shading through proposed slabs only

Case Description Model for Passive shading through Slabs - **Thermal Model**



Case 2 This case represents the passive shading through slabs and the Vertical Timber curtains simultaneously.

Case Description Model for Passive shading through Slabs and Timber Curtains -**Thermal Model**



Case 3 This is an indicative case for glazing selection.(this will be discussed in detail later but few important aspect of saving through glazing are highlighted for this building)

Case Description Model for Passive shading through Slabs and Timber Curtains and Better Glazing option

Note : The Thermal Model is same as Case 2, but with changed glazing

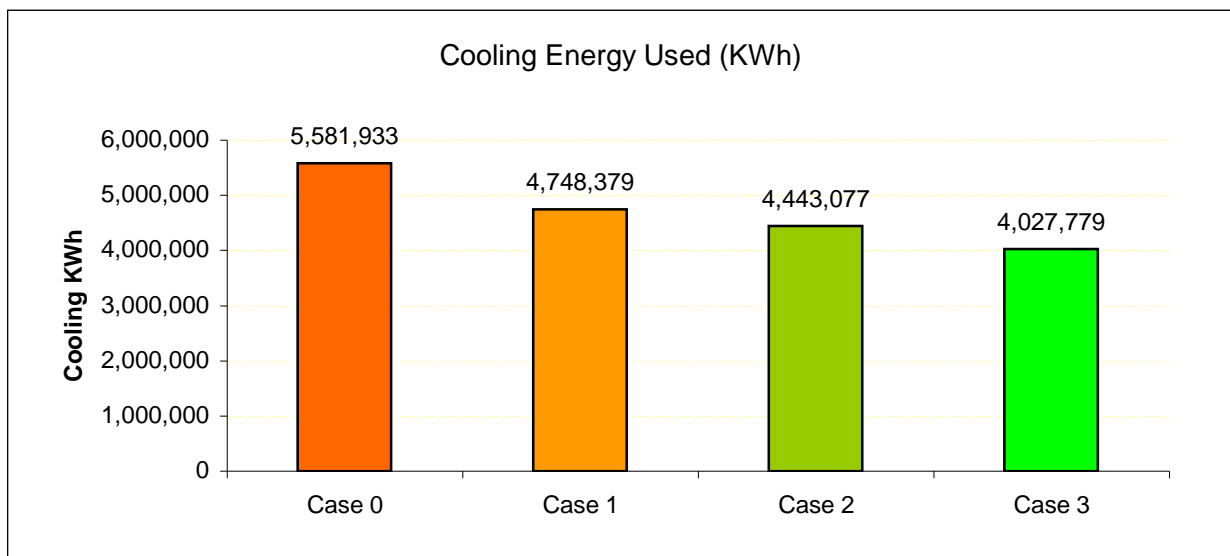
Results

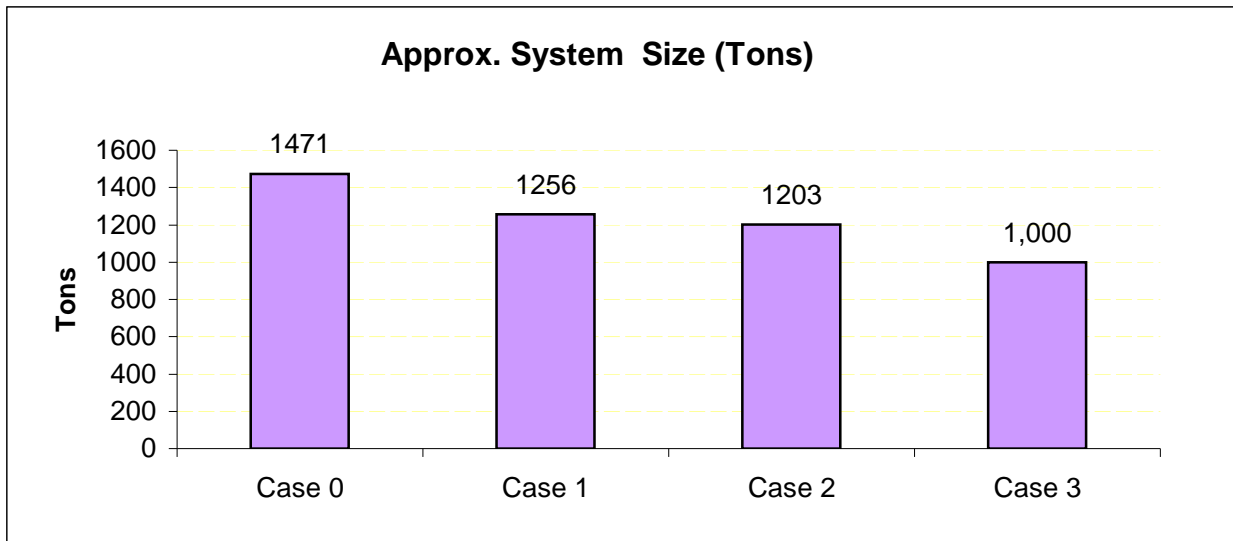
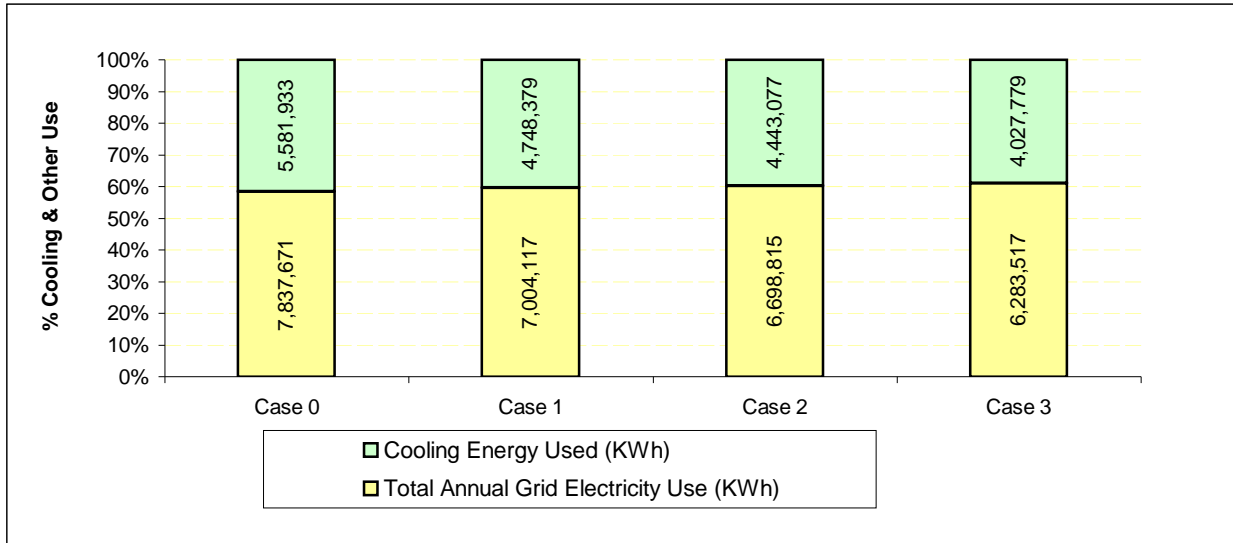
Hourly whole building simulations were performed for 8760 hour to assess solar heat gain factors due to various shading schemes. It is important to understand the assumption that timber screens are modeled as an equivalent percentage solid to save on the computation time.

Also the other parameters like schedules, lighting and occupancy gains were modeled using ASHRAE as a reference for all the cases. These assumptions would be refined after detailed meeting with the clients and architects about the target use of the building for its various zones.

Tables and Plots

EEM	Total Annual Grid Electricity Use (KWh)	Cooling Energy Used (KWh)	Energy Use/Conditioned Area (KWh/m2/yr.)	System Size (Tons)	Cost of Building Operation @ Rs.6/KWh
Case 0	7,837,671	5,581,933	243	1471	INR 47,026,028
Case 1	7,004,117	4,748,379	217	1256	INR 42,024,704
Case 2	6,698,815	4,443,077	207	1203	INR 40,192,889
Case 3	6,283,517	4,027,779	195	1,000	INR 37,701,099





Financial Analysis

Years	Future Value Factor	Case 0	Case 1	Case 2	Case 3
0	1	47,026,028	42,024,704	40,192,889	37,701,099
1	1.06	49,847,590	44,546,186	42,604,462	39,963,165
2	1.1236	52,838,445	47,218,957	45,160,730	42,360,955
3	1.191016	56,008,752	50,052,095	47,870,374	44,902,612
4	1.26247696	59,369,277	53,055,221	50,742,596	47,596,769
5	1.338225578	62,931,433	56,238,534	53,787,152	50,452,575
6	1.418519112	66,707,319	59,612,846	57,014,381	53,479,729
7	1.503630259	70,709,759	63,189,617	60,435,244	56,688,513
8	1.593848075	74,952,344	66,980,994	64,061,359	60,089,824
9	1.689478959	79,449,485	70,999,853	67,905,040	63,695,213
10	1.790847697	84,216,454	75,259,844	71,979,343	67,516,926
11	1.898298558	89,269,441	79,775,435	76,298,103	71,567,942
12	2.012196472	94,625,608	84,561,961	80,875,989	75,862,018
13	2.13292826	100,303,144	89,635,679	85,728,549	80,413,739
14	2.260903956	106,321,333	95,013,820	90,872,262	85,238,564
15	2.396558193	112,700,613	100,714,649	96,324,597	90,352,878
16	2.540351685	119,462,649	106,757,528	102,104,073	95,774,050
17	2.692772786	126,630,408	113,162,979	108,230,318	101,520,493

18	2.854339153	134,228,233	119,952,758	114,724,137	107,611,723
19	3.025599502	142,281,927	127,149,923	121,607,585	114,068,426
20	3.207135472	150,818,843	134,778,919	128,904,040	120,912,532
21	3.399563601	159,867,973	142,865,654	136,638,282	128,167,284
22	3.603537417	169,460,051	151,437,593	144,836,579	135,857,321
23	3.819749662	179,627,655	160,523,849	153,526,774	144,008,760
24	4.048934641	190,405,314	170,155,280	162,738,381	152,649,286
25	4.29187072	201,829,633	180,364,597	172,502,683	161,808,243
		2,781,889,710	2,486,029,473	2,377,665,924	2,230,260,641

Note: Cost of Timber is assumed to be 1,000 INR/ft³
width of timber rod is 0.010 m
Workmen ship cost is considered to be 1.3 times

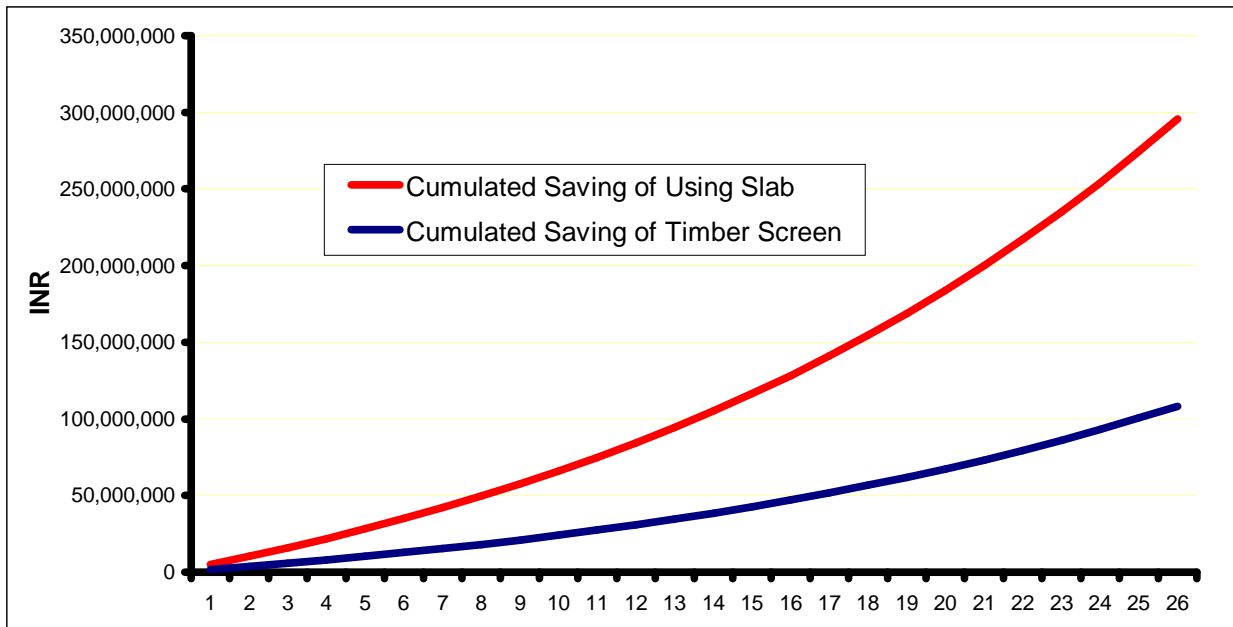
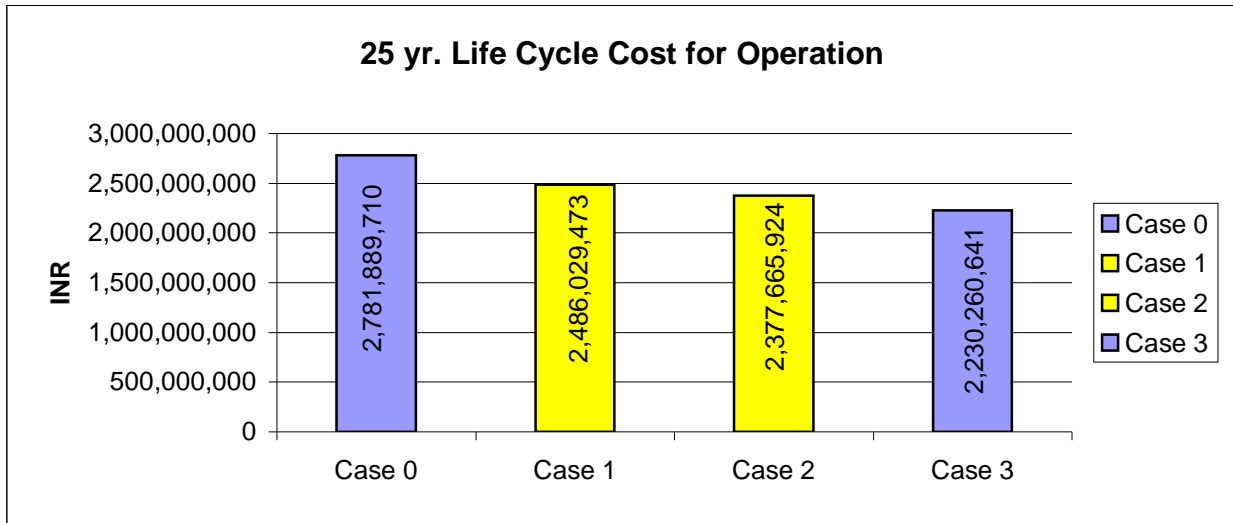
Timber Use Calculation

Residential	517 m ²		
Hotel	282 m ²		
Office	748 m ²		
Total Solid Area Covered By Timber	1547 m ²		
Volume Of Timber to be used	15.47 m ³	OR	546 ft ³

Cost of Screen INR 710,213

Years	Saving of Slab Shade from No Slab or Baseline building (Case0-Case1) (INR)	SavingUse of Timber Screens from only Slabs (Case1-Case2) (INR)	Saving due to All shading Mechanism and Baseline Building (Case0-Case2) in (INR)	Cumulated Saving of Using Slab	Cumulated Saving of Timber Screen
0	5,001,324	1,831,815	6,833,139	5,001,324	1,831,815
1	5,301,403	1,941,724	7,243,127	10,302,727	3,773,539
2	5,619,488	2,058,227	7,677,715	15,922,215	5,831,766
3	5,956,657	2,181,721	8,138,378	21,878,872	8,013,487
4	6,314,056	2,312,624	8,626,681	28,192,928	10,326,111
5	6,692,900	2,451,382	9,144,281	34,885,828	12,777,493
6	7,094,474	2,598,465	9,692,938	41,980,302	15,375,958
7	7,520,142	2,754,372	10,274,515	49,500,444	18,130,330
8	7,971,351	2,919,635	10,890,985	57,471,794	21,049,965
9	8,449,632	3,094,813	11,544,445	65,921,426	24,144,778
10	8,956,610	3,280,502	12,237,111	74,878,036	27,425,280
11	9,494,006	3,477,332	12,971,338	84,372,042	30,902,611
12	10,063,647	3,685,972	13,749,618	94,435,688	34,588,583
13	10,667,465	3,907,130	14,574,595	105,103,154	38,495,713
14	11,307,513	4,141,558	15,449,071	116,410,667	42,637,271
15	11,985,964	4,390,051	16,376,015	128,396,631	47,027,322
16	12,705,122	4,653,454	17,358,576	141,101,753	51,680,776
17	13,467,429	4,932,662	18,400,091	154,569,182	56,613,438
18	14,275,475	5,228,621	19,504,096	168,844,657	61,842,059
19	15,132,003	5,542,339	20,674,342	183,976,660	67,384,398
20	16,039,924	5,874,879	21,914,802	200,016,584	73,259,277
21	17,002,319	6,227,372	23,229,691	217,018,903	79,486,648
22	18,022,458	6,601,014	24,623,472	235,041,361	86,087,662
23	19,103,806	6,997,075	26,100,880	254,145,167	93,084,737

24	20,250,034	7,416,899	27,666,933	274,395,201	100,501,636
25	21,465,036	7,861,913	29,326,949	295,860,237	108,363,549



Conclusion

- 1 The payback Period of The timber Screen is ----->> **4.65 Months**
- 2 Cumulated Saving by using timber screen is of the order of ----->> **INR 1,831,815**
- 3 Cumulated Saving by using passive slab shading is of the order of ----->> **INR 5,001,324**
- 4 Only by using these Timber shading devices we can save on the building heat load to a level of **59 Tons**
- 5 Saving achieved in system size by using Passive Slab shade and the timber screen is or the order of **269 Tons** for entire prakriti rose complex
- 6 The difference in 25 yr. Life Cycle cost of building operation with and without all shading Mechanism is of the order of **INR 404,223,786**
- 7 The cost of timber is approximated to a value of INR 1000/Cubic feet, this can be adjusted to a more realistic value in the above calculation